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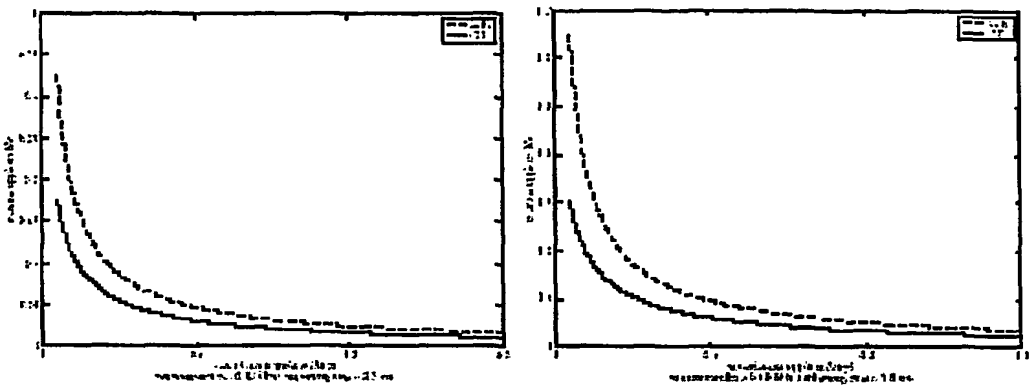
(54) Title: PRACTICAL PULSE SYNTHESIS VIA THE DISCRETE INVERSE SCATTERING TRANSFORM



(a) Transition width = 0.3 KHz, rephasing time = 2.0 ms

(b) Transition width = 0.1 KHz, rephasing time = 5.0 ms

(57) Abstract: The discrete inverse scattering (DIST) approach is used to design selective RFpulses. As in SLR, a hard pulse approximation is used to actually design the pulse. Unlike SLR, the pulse is designed using the full inverse scattering data (the reflection coefficient and the bound states) rather than the flip angle profile. The reflection coefficient is approximated in order to obtain a pulse with a prescribed rephasing time. In contrast to the SLR approach, direct control on the phase of the magnetization profile is retained throughout the design process. Explicit recursive algorithms are provided for computing the hard pulse from the inverse scattering data. These algorithms are essentially discretizations of the Marchenko equations. When bound states are present, both the left and right Marchenko equations are used in order to improve the numerical stability of the algorithm. The DIST algorithm is used in preferred applications to generate pulses for use in magnetic resonance imaging, although it has applications in other two-level quantum systems such as quantum computing and spintronics.

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